INTERCHANGEABLE CORE MUFFLER

This application claims the benefit of U.S. Provisional Patent Application No. 60/455,916 which was filed on March 19, 2003.

BACKGROUND OF THE INVENTION

This invention relates to mufflers for engines. More particularly, the invention relates to a muffler having an interchangeable core to allow the owner of the engine to which the muffler is attached to change the sound of the exhaust emanating from the engine.

Typically, exhaust from an internal combustion engine enters a muffler housing. The muffler housing can include a plurality of chambers and baffles that can reflect and reverse the direction of travel of the exhaust. While traveling through the muffler housing the noise from the exhaust is attenuated to a desired exhaust sound. However, the reversal of direction of the exhaust inside the muffler housing can result in back pressure imposed on the engine, affecting the vehicle's performance.

Automobile or motorcycle enthusiasts are constantly looking for ways to improve performance and the sound of the exhaust from their vehicle. In the past, to change the performance or sound of the automobile exhaust system required the owner of the automobile to remove the entire muffler and sometimes additional portions of the exhaust system. The owner replaced the old muffler with a new muffler having different resonance characteristics. It should be appreciated that this prior process was time consuming and costly.

Accordingly, it is desirable to provide a muffler that allows a vehicle owner the flexibility to change the performance and sound characteristics of the exhaust system of the vehicle quickly and relatively inexpensively.

SUMMARY OF THE INVENTION

A muffler includes a housing, a selectively removable insert, and a coupling. The housing includes a first section and a second section selectively removable from the first section. The first section includes a sidewall defining a chamber. The insert includes a sound diffuser and a spacer. The insert is received in the chamber and the sound diffuser extends along a longitudinal axis of the housing. The spacer abuts the sidewall of the housing for spacing the sound diffuser from the sidewall. The coupling selectively attaches the first section of the housing to the second section of the housing.

A muffler includes a housing having a sidewall defining a chamber, a first section, a removable second section, an inlet opening to allow exhaust to enter the chamber and an outlet opening to allow exhaust to exit the chamber. The muffler also includes a selectively removable insert received in the chamber. The insert includes a spacing member affixed to a sound diffusing member, wherein the spacing member engages the side wall of the housing to space the sound diffusing member from the side wall of the housing. The muffler also includes a coupling for selectively attaching the housing first section to the housing second section.

A muffler includes a housing having a side wall defining a chamber. The housing includes a first section and a removable second section. Each of

the first section and the second section includes a flange. The flanges abut one another when the first section attaches to the second section. A selectively removable insert is received in the chamber of the housing. A coupling is provided for selectively attaching the housing first section to the housing second section. The coupling includes a band having a first side wall depending from the band and a second side wall spaced from the first side wall and depending from the band. The side walls contact the flanges when the coupling attaches the first housing section to the second housing section.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may take form in certain components and structures, preferred embodiments of which will be illustrated in the accompanying drawings wherein:

FIG. 1 is an exploded perspective view of a muffler assembly according to a first embodiment of the present invention;

FIG. 2 is an assembled perspective view of the muffler assembly of FIG. 1 attached to a schematic vehicle;

FIG. 3 is a close up perspective view of the interface of a muffler housing and a tail pipe of the muffler assembly of FIG. 1;

FIG. 4 is an enlarged perspective view of the interchangeable insert of the muffler assembly of FIG. 1 inside the muffler housing;

FIG. 5 is a perspective view of an alternate embodiment of an interchangeable insert for the muffler assembly of FIG. 1;

FIG. 6 is a close up perspective view of the attachment of a ring of a coil to a rib of the insert of FIG. 4;

FIG. 7 is a perspective end view of the insert of FIG. 5;

FIG. 8 is an alternate embodiment of an insert for the muffler assembly of FIG. 1; and,

FIG. 9 is an enlarged perspective end view of the insert of FIG. 7.

DETAILED DESCRIPTION OF THE INVENTION

It is to be understood that specific devices and processes illustrated in the attached drawings, and described in the following specification are simply exemplary embodiments of the inventive concepts. Hence, specific examples and characteristics relating to the embodiments disclosed herein are not to be considered as limiting. Also, the muffler assembly will be described with reference to an automobile, however this reference is simply used to illustrate only one environment in which the inventive muffler assembly can be used and should not be considered as limiting the invention to use only with an automobile. For example, the muffler assembly can be used with a motorcycle, a boat, a snowmobile, or any vehicle that includes an internal combustion engine. Moreover, the muffler assembly can also be used on stationary engines.

With reference to FIG. 1, the inventive muffler assembly A includes a muffler housing 10, a tailpipe 12, a coupling 14, and an interchangeable insert 16. The housing 10 receives the interchangeable insert 16. The coupling 14 fastens the housing 10 to the tail pipe 12 to enclose or house the insert 16. The housing 10 can be made of a metal, such as steel. Likewise, the tailpipe 12 and the coupling 14 can also be made of metal, and can be made of the

same material as the housing. The interchangeable insert 16 also can be made of metal.

With reference now also to FIG. 2, the housing 10 includes a cylindrical side wall 18. The housing 10 also includes a substantially closed end 20 and an open end 22 (FIG. 1). A chamber 24 is defined by an end wall 26 at the closed end 20 and the side wall 18. A conduit 28 attaches to the end wall 26. An opening (not visible) in the end wall 26 allows communication between the conduit 28 and the chamber 24. An exhaust inlet 30 situated at an opposite end of the conduit 28 as the opening in the end wall 26 allows exhaust to enter the conduit and thus the chamber 24.

To connect the muffler assembly A to an associated engine, the conduit 28 attaches to an exhaust conduit or pipe (not shown) leading from an internal combustion engine (not shown). Clamps 32 are provided so that the exhaust conduit from the engine can be slipped into the exhaust inlet 30 and the conduit 28 can be tightened around the internal combustion engine's exhaust conduit. Slits 34 can be provided in the conduit 28 to facilitate the reduction of the diameter of the conduit 28 around the exhaust pipe of the engine. It should be recognized that the conduit 28 could also be secured to the exhaust pipe of an engine in other conventional ways such as a threaded male/female connection, welding, gaskets or seals, and the like.

The conduit 28 attaches to the end wall 26, which is attached to the side wall 18 of the housing 10. The end wall 26 allows for the change in diameter between the inlet 30 and the chamber 24. The conduit 28 and the side wall 18 depicted in FIG. 2 are circular in longitudinal cross-section, however the conduit and the wall can take other configurations, such as

elliptical or oval-shaped, for example. A flange 36 is situated around the periphery of the open end 22 of the housing 10. The flange 36 comprises an annular ridge that surrounds the circumference of an open end of the housing 10. The flange 36 facilitates the connection between the housing 10 and the tail pipe 12.

The tail pipe 12 attaches to the muffler housing 10 and closes the open end 22 of the housing. The tail pipe 12 includes a flange 38 that abuts the flange 36 of the muffler housing 10, an end wall 40, and a conduit 42 extending away from the end wall 40 that defines an exhaust outlet passageway 44. Since flange 38 abuts flange 36, they have complementary dimensions. The end wall 40 acts to close the open end 22 of the housing 10. The diameter of the passage through the muffler housing, i.e. the chamber 24, is reduced at its outlet end to the diameter of the outlet passageway 44 defined by the outlet conduit 42. As is evident from FIG. 2, however, the diameter of the outlet passageway 44 can be larger than a diameter of the conduit 28.

The coupling 14 attaches the muffler housing 10 to the tail pipe 12. More specific to the embodiment depicted in FIG. 3, the coupling 14 surrounds the flanges 36 and 38. A specific type of coupling will be described, however other known coupling assemblies can be used to attach the housing 10 to the tail pipe 12. Also, the connection between the housing 10 and the tail pipe 12 can be made without an external coupling, for example a threaded male/female connection or similar conventional connection can be employed.

With continued reference to FIG. 3, the coupling 14 includes a band 50 having a base wall 52 and lateral side walls 54 and 56 depending from the base wall 52. The side walls of 54 and 56 engage the flanges 36 and 38. The coupling 14 has a first end 58 and a second end 60. The ends 58 and 60 are drawn toward one another to reduce the diameter of the coupling to engage the flanges and fasten the muffler housing 10 to the tail pipe 12.

A first retainer 62 attaches to the first end 58 of the coupling 14. The first retainer includes a loop 64 that defines an opening 66. The loop 64 also includes a radial slot 68. A T-bolt 72 is pivotally mounted to the retainer 62 such that a head of the bolt resides in the opening 66 and the shank 74 of the bolt 72 protrudes through the slot 68 such that a threaded portion 76 reaches towards the second end 60 of the coupling 14.

The second end 60 of the coupling 14 includes a second retainer 80. The second retainer includes a loop 82 defining an opening 84 and having a radial slot 86. A T-shaped saddle 88 is mounted to the retainer 80 such that a head of the saddle resides in the opening 84 and a stem of the saddle resides in the slot 88. The saddle 88 receives the bolt 72. A nut 90 is threaded onto the threaded end 76 of the bolt 72 to draw the second end 60 of the coupling 14 towards the first end 58 of the coupling.

With reference back to FIG. 2, the muffler assembly A can also include hangers, schematically shown at 92, so that the muffler assembly can be mounted to a vehicle, schematically depicted at V, such as an automobile, for example. Conventional hangers that are well known in the art can be used to mount the muffler assembly to the frame of the vehicle.

With reference now to FIG. 4, the interchangeable insert 16 that is received in the chamber 24 of the muffler housing 10 is there shown. Only a few of many possible interchangeable inserts are disclosed in FIGS. 4-9. The figures and accompanying descriptions are to provide examples of possible inserts. Generally, the inserts are received in the housing 10 of the muffler assembly. Different inserts will result in different sounds emanating from the exhaust system. The size, shape or material of the insert can be changed to change the sound of the exhaust. Using different metals and/or different structures for the interchangeable insert 16 can result in different sounds resonating from the muffler assembly. Two, non-limiting examples, of metal from which a metal interchangeable insert can be made include titanium and 300 series stainless steel.

Referring again to FIG. 4, the insert 16 includes a continuous coil 100 attached to longitudinal ribs 102 and 104. The ribs 102 and 104 run the length of the continuous coil 100. The coil 100 and the ribs 102, 104 are sized such that they snuggly fit inside the chamber 24 of the muffler housing 10. Accordingly, the insert 16 remains in the chamber as a result of the friction fit between the ribs 102 and 104 and the side wall 18 of the housing 10. The ribs 102 and 104 provide stiffness to one of both ends of the coil 100. In the embodiment depicted, the ribs 102, 104 are elongated rectangular beams having a narrow width. The ribs attach to the coil 100 at their narrow edge to increase the flexural rigidity of the coil in a direction along the longitudinal axis of the coil 100 and housing 10. Bars 106 and 108 attach near an end of the continuous coil 100 and do not run the longitudinal length of the coil 100. The bars 106 and 108 can also provide stiffness to one or

both ends of the coil 100. The ribs 102 and 104 and the bars 106 and 108 can also contact the end walls 26 and 40. By contacting the end walls 26 and 40, a space is formed between the end rings of the coil 100 and the end walls 26 and 40. Accordingly, the rings do not contact the end walls to cause any unwanted rattling. The ribs and the bars are depicted as being spaced 90 degrees apart from one another on the coil, however the spacing and number of ribs and bars can be changed to change the characteristics of the sound emanating from the muffler.

Individual rings 110 of the coil 100 attach to the ribs 102 and 104 at attachment points 112 and to the bars 106 and 108 at attachment points 114. The coil 100 can attach to the ribs and the bars by welding, or any known conventional method. The individual rings 110 are spaced from one another at a distance "x." The distance "x" can be varied to result in different sound qualities emanating from the muffler assembly A. Each ring has a somewhat U-shaped or V-shaped configuration in cross-section. In this embodiment, only one of the legs of the U or V of the ring 110 is attached to the ribs 102 and 104 and the bars 106 and 108, however in an alternate embodiment both legs could be attached to the ribs and/or bars.

It is desirable that the insert 16 be made from a metal that has a faster thermal expansion rate than the metal of the housing 10. In this way, as the muffler is exposed to hot exhaust gases from the engine, the insert 16 expands more than the housing to tighten the fit of the insert in the housing and prevent any rattling noises in the muffler.

With reference to FIG. 5, another embodiment of an interchangeable insert 116 is there shown. Since this insert 116 is structurally different from

the above-described insert 16, it should have a different sound characteristic. The insert 116 includes a continuous coil 200 attached to longitudinal ribs 202. In this embodiment, three longitudinal ribs 202 are spaced 120 degrees apart, however may other arrangements can be used to produce other sounds. The coil 200 and the ribs 202 are sized such that they fit snugly inside the chamber 24 of the muffler housing 10. The ribs 202 provide stiffness to the coil 200.

The ribs 202 are connected at a first end to a ring 206 and at a second end to a plate 208. A projection 202a of the ribs 202 can extend through the plate 208 in a direction opposite from the coil 200. The plate 208 includes ears 210 spaced equidistantly apart from one another around the circumference of the plate. The ears 210 include notches 212 to receive the ribs 202. The circumference of the plate 208 is substantially similar to the circumference of an individual ring 214 of the coil 200 with the ears 210 projecting outwardly from the circumference. The free end of each projection 202a contacts the end wall 40 of the tail pipe 12. Accordingly, a space exists between the plate 208 and the end wall 40, so that no unwanted rattling between the plate 208 and the end wall 40 can occur when the exhaust travels through the coil 200.

With reference to FIG. 6, the coil 200 is attached to the rib 202 by welds 204. In addition to welding, the coil 200 can be attached to the ribs 202 by way of any known conventional method. The individual rings 214 of the coil 200 have a somewhat U-shaped or V-shaped configuration in cross-section. In this embodiment, only one of the legs of the U or V is attached to the rib 202. However, as is evident from FIG. 6, the leg which is welded to the

rib 202 is longer than the other leg so that the other leg does not contact the rib to produce unwanted rattling noises. Referring back to FIG. 5, the rings 214 of the coil 200 are spaced a distance "x" from one another. The distance "x" can be varied to result in different sound qualities emanating from the muffler assembly A. As a comparison, the rings 214 of the insert 116 depicted in FIG. 5 are spaced farther apart than are the rings 110 of the insert 16 depicted in FIG. 4.

With reference to FIG. 7, pads 218 are attached to the ring 206. The pads 218 prevent rattling between the end wall 26 and the interchangeable insert 116. The pads in this embodiment comprise an insulating high temperature cork. Also, the pads 218 can also provide a resilient member between the ring 206 and the housing 10, which can compensate for the differential rates of thermal expansion between the housing 10 and the insert 116. For example, if a different type of metal is used for the insert than for the muffler housing, the housing and the insert may expand or contract, due to the heat generated, at different rates.

Exhaust from the associated internal combustion engine (not shown) enters the conduit 28 and then enters the chamber 24. For the insert depicted in FIGS. 5-7, the exhaust travels through the opening in ring 206 and travels through and around the individual rings 214 of the coil 200. The exhaust must travel around the plate 208 before leaving the chamber 24 and entering the outlet passageway 44 of the tail pipe 12. In the embodiment of FIGS. 5-7, the exhaust travels a more tortuous flow path than in the embodiment of FIGS. 1-4, thus leading to a greater attenuation of sound.

With reference now to FIG. 8, still another embodiment of an interchangeable insert 216 is there shown. This insert 216 is provided to create a different exhaust sound from the engine's exhaust as compared to the inserts described above. The insert 216 includes a cylindrical wall 300 having a plurality of radial holes 302. A ring 304 is attached to a first end of the cylindrical wall 300. The first ring 304 includes tabs 306 spaced equidistantly around the circumference of the ring. In this embodiment, three tabs 306 are spaced at 120° intervals around the ring 304. The tabs 306 includes slots 308 centrally located in the tabs. As best shown in FIG. 9, the ring 304 can be welded to the cylindrical wall 300, such as at weld joints 310.

A second ring 312 is attached to the cylindrical wall 300 at an opposite end to the first ring 304. If desired, the second ring can be identical to the first ring. The second ring 312 also includes tabs 314 aligned with the tabs 306 of the first ring 304. The tabs 314 also include openings 316. In this embodiment, the openings 316 receive rods 318. The rods 318 provide a structure to hold a known cone (not shown). In this embodiment, fiberglass (not shown) can be packed inside the cylinder 300, and also between the cylinder 300 and the housing 10, as is well known in the art. In this embodiment, the exhaust from the engine would also travel through an opening in the ring 304. If fiberglass were placed inside the cylindrical wall 300, the exhaust would have to travel through that first before leaving the chamber 24.

As discussed earlier, many different interchangeable inserts can be inserted inside the chamber 22 to change the sound of the exhaust emanating from the engine. Only a small sample of such inserts have been disclosed in

this specification. When designing inserts for the above-described muffler assembly, unless a rattling sound is desired, the insert should fit snugly inside the muffler housing chamber. Furthermore the design should include items or structures to accommodate for any difference in thermal expansion between the components of the muffler assembly. Cushioning devices can be used to accommodate for thermal expansion differences. Such items or structures can be placed elsewhere, besides on the plates described with reference to FIGS. 4-6. Furthermore, if a different metal is used for the insert than for the housing, the design of the muffler assembly should accommodate for the differences in thermal expansion between the two. It is desirable that the housing when exposed to hot exhaust gases would not expand more quickly than the insert since that would allow the insert to loosen its fit in the housing, which can result in an unwanted rattling.

While preferred embodiments of the invention are disclosed herein, this is not intended to be limiting. Rather, the general principles set forth herein are considered to be merely illustrative of the scope of the present invention and it is to be further understood that numerous changes may be made without straying from the scope of the present invention.